

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884
Attorney Docket No.: CSCO-002/94701

Listing of Claims

1 1. (Original) A method of processing a plurality of keep-alive messages generated by
2 a corresponding plurality of end systems, each of said plurality of keep-alive messages being
3 designed to request the status of a corresponding point to point (PPP) session implemented
4 on a communication network, said method comprising:

5 receiving in an aggregation device said plurality of keep-alive messages;
6 generating in said aggregation device an aggregated request packet which indicates
7 that the status of said PPP sessions is requested; and
8 sending said aggregated request packet on said communication network to a peer
9 aggregation device.

1 2. (Original) The method of claim 1, further comprising:
2 receiving said aggregated request packet in said peer aggregation device;
3 indicating the status of said plurality of sessions in an aggregated reply packet; and
4 sending said aggregated reply packet to said aggregation device.

1 3. (Original) The method of claim 1, further comprising receiving in said aggregation
2 device an aggregated reply packet from said peer aggregation device, wherein said
3 aggregated reply packet indicates the status of at least some of said plurality of PPP sessions.

1 4. (Previously Amended) The method of claim 3, further comprising sending from
2 said aggregation device a proxy keep-alive reply message to one of said plurality of end
3 systems originating a corresponding one of said keep alive-messages without waiting for said
4 aggregated reply packet.

1 5. (Original) The method of claim 4, further comprising:
2 maintaining a remote status table in said aggregation device, wherein said remote
3 status table indicates the status of sessions supported by said aggregation device;
4 updating said remote status table with the information in said aggregated reply packet;
5 and
6 generating said proxy keep-alive reply according to said remote status table.

Reply to Final Office Action of December 21, 2004

Appl. No.: 09/785,884

Amendment Dated: February 17, 2005

Attorney Docket No.: CSCO-002/94701

1 6. (Original) The method of claim 5, wherein said proxy keep-alive message indicates
2 that the corresponding session is alive/OK when a first keep-alive message is received for the
3 corresponding session.

1 7. (Original) The method of claim 6, further comprising initializing the status of each
2 of said session to alive/OK such that said proxy keep-alive message in response to said first
3 keep-alive message indicates alive/OK status.

1 8. (Original) The method of claim 1, wherein said communication network is
2 implemented using one of frame relay, ATM and IP networks.

1 9. (Original) The method of claim 1, wherein said aggregation device is one of a
2 network access server and home gateway.

1 10. (Original) A method of processing an aggregated request packet in an aggregation
2 device, wherein said aggregated request packet indicates that the status of a plurality of point-
3 to-point sessions are requested, said method comprising:

4 examining said aggregated request packet to determine said plurality of point-to-point
5 sessions;

6 determining the status of each of said plurality of point-to-point sessions;

7 generating an aggregated reply packet indicating the status of said plurality of point-
8 to-point sessions; and

9 sending said aggregated reply packet to said peer aggregation device.

1 11. (Original) The method of claim 10, wherein said determining comprises accessing
2 a local status table which contains the status information of at least some of said plurality of
3 point-to-point sessions.

1 12. (Original) The method of claim 10, wherein said generating comprises including
2 a client magic number associated with each of said plurality of point-to-point sessions.

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884
Attorney Docket No.: CSCO-002/94701

1 13. (Original) The method of claim 10, wherein said generating comprises setting a
2 bit to one logical value to indicate that a corresponding one of said plurality of sessions is
3 OK/alive, and to another logical value to indicate that said corresponding one of said plurality
4 of session not OK/alive.

1 14. (Original) The method of claim 10, wherein said aggregation device comprises
2 one of a network access server (NAS) and a home gateway implemented in a communication
3 network.

1 15. (Original) An aggregation device for processing a plurality of keep-alive
2 messages generated by a corresponding plurality of end systems, each of said plurality of
3 keep-alive messages being designed to request the status of a corresponding point to point
4 (PPP) session implemented on a communication network, said aggregation device
5 comprising:

6 an input interface receiving said plurality of keep-alive messages;
7 a message aggregator coupled to said input interface, said message aggregator
8 examining said plurality of message and generating data according to a format indicating that
9 the status of said PPP sessions is requested; and
10 an output interface sending an aggregated request packet on said communication
11 network to a peer aggregation device, said aggregated request packet containing said data
12 generated by said message aggregator.

1 16. (Original) The aggregation device of claim 15, further comprising an encapsulator
2 encapsulating said data in a packet suitable for transmission on said communication network.

1 17. (Original) The aggregation device of claim 16, further comprising:
2 a remote status table indicating the status of sessions supported by said aggregation
3 device; and
4 a de-aggregator receiving an aggregated reply packet from said peer aggregation
5 device, wherein said aggregated reply packet indicates the status of at least some of said

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884

Attorney Docket No.: CSCO-002/94701

6 plurality of PPP sessions, said de-aggregator updating said remote status table with the
7 information in said aggregated reply packet.

1 18. (Original) The aggregation device of claim 17, further comprising a proxy reply
2 unit sending a proxy keep-alive reply message to one of said plurality of end systems
3 originating a corresponding one of said keep alive-messages without waiting for said
4 aggregated reply packet.

1 19. (Original) The invention of claim 18, wherein said aggregation device comprises
2 a network access server.

1 20. (Original) The aggregation device of claim 18, wherein said aggregated request
2 packet contains a magic number related to each of the corresponding sessions.

1 21. (Original) An aggregation device for processing a plurality of keep-alive
2 messages generated by a corresponding plurality of end systems, each of said plurality of
3 keep-alive messages being designed to request the status of a corresponding point to point
4 (PPP) session implemented on a communication network, said aggregation device
5 comprising:

6 first means for receiving said plurality of keep-alive messages;
7 means for generating an aggregated request packet which indicates that the status of
8 said PPP sessions is requested; and
9 means for sending said aggregated request packet on said communication network to
10 a peer aggregation device.

1 22. (Original) The aggregation device of claim 21, further comprising second means
2 for receiving an aggregated reply packet from said peer aggregation device, wherein said
3 aggregated reply packet indicates the status of at least some of said plurality of PPP sessions.

1 23. (Original) The aggregation device of claim 22, further comprising means for
2 sending a proxy keep-alive reply message to one of said plurality of end systems originating

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884

Attorney Docket No.: CSCO-002/94701

3 a corresponding one of said keep alive-messages without waiting for said aggregated reply
4 packet.

1 24. (Original) The aggregation device of claim 23, further comprising:
2 means for maintaining a remote status table in said aggregation device, wherein said
3 remote status table indicates the status of sessions supported by said aggregation device;
4 means for updating said remote status table with the information in said aggregated
5 reply packet; and
6 means for generating said proxy keep -alive reply according to said remote status table.

1 25. (Original) An aggregation device for processing an aggregated request packet,
2 wherein said aggregated request packet indicates that the status of a plurality of point-to-point
3 sessions are requested, said aggregation device comprising:
4 means for examining said aggregated request packet to determine said plurality of
5 point-to-point sessions;
6 means for determining the status of each of said plurality of point-to-point sessions;
7 means for generating an aggregated reply packet indicating the status of said plurality
8 of point-to-point sessions; and
9 means for sending said aggregated reply packet to said peer aggregation device.

1 26. (Original) The aggregation device of claim 25, wherein said means for
2 determining comprises means for accessing a local status table which contains the status
3 information of at least some of said plurality of point-to-point sessions.

1 27. (Original) The aggregation device of claim 25, wherein said means for generating
2 includes a client magic number associated with each of said plurality of point-to-point
3 sessions.

1 28. (Original) The aggregation device of claim 25, wherein said means for generating
2 sets a bit in said aggregated reply packet to one logical value to indicate that a corresponding

Reply to Final Office Action of December 21, 2004 Appl. No.: 09/785,884
Amendment Dated: February 17, 2005 Attorney Docket No.: CSCO-002/94701

3 one of said plurality of sessions is OK/alive, and to another logical value to indicate that said
4 corresponding one of said plurality of session not OK/alive.

1 29. (Original) The aggregation device of claim 25, wherein said aggregation device
2 comprises one of a network access server (NAS) and a home gateway implemented in a
3 communication network.

1 30. (Original) An aggregation device for processing an aggregated request packet,
2 wherein said aggregated request packet indicates that the status of a plurality of point-to-point
3 sessions are requested, said aggregation device comprising:

4 an input interface receiving said aggregated request packet;
5 a de-encapsulator examining said aggregated request packet to determine that said
6 aggregated request packet relates to requesting the status of point-to-point sessions;
7 a reply generator determining the status of each of said plurality of point-to-point
8 sessions, and generating an aggregated reply packet indicating the status of said plurality of
9 point-to-point sessions; and

10 an output interface sending said aggregated reply packet to said peer aggregation
11 device.

1 31. (Original) The aggregation device of claim 30, further comprising a local status
2 table storing the status information of at least some of said plurality of point-to-point
3 sessions, wherein said reply generator determines the status of said at least some of said
4 plurality of point-to-point sessions by accessing said local status table.

1 32. (Original) The aggregation device of claim 31, further comprising a session
2 manager updating the status of said plurality of point-to-point sessions in said local status
3 table.

1 33. (Original) The aggregation device of claim 30, wherein said reply generator
2 includes in said aggregated reply packet a client magic number associated with each of said
3 plurality of point-to-point sessions.

Reply to Final Office Action of December 21, 2004

Appl. No.: 09/785,884

Amendment Dated: February 17, 2005

Attorney Docket No.: CSCO-002/94701

1 34. (Original) The aggregation device of claim 30, wherein said reply generator sets
2 a bit in said aggregated reply packet to one logical value to indicate that a corresponding one
3 of said plurality of sessions is OK/alive, and to another logical value to indicate that said
4 corresponding one of said plurality of session not OK/alive.

1 35. (Original) The aggregation device of claim 30, further comprising a keep-alive
2 processor coupled to said de-encapsulator, wherein said keep-alive processor examines said
3 aggregated request packet to determine that status of point-to-point sessions is requested and
4 causes said reply generator to generate said aggregated reply packet.

1 36. (Original) The aggregation device of claim 30, wherein said aggregation device
2 comprises one of a network access server (NAS) and a home gateway implemented in a
3 communication network.

1 37. (Original) A computer-readable medium carrying one or more sequences of
2 instructions for causing a aggregation device to process a plurality of keep-alive messages
3 generated by a corresponding plurality of end systems, each of said plurality of keep-alive
4 messages being designed to request the status of a corresponding point to point (PPP) session
5 implemented on a communication network, wherein execution of said one or more sequences
6 of instructions by one or more processors contained in said aggregation device causes said
7 one or more processors to perform the actions of:

8 receiving in an aggregation device said plurality of keep-alive messages;
9 generating in said aggregation device an aggregated request packet which indicates
10 that the status of said PPP sessions is requested; and
11 sending said aggregated request packet on said communication network to a peer
12 aggregation device.

1 38. (Original) The computer-readable medium of claim 37, further comprising:
2 receiving said aggregated request packet in said peer aggregation device;
3 indicating the status of said plurality of sessions in an aggregated reply packet; and

Reply to Final Office Action of December 21, 2004

Appl. No.: 09/785,884

Amendment Dated: February 17, 2005

Attorney Docket No.: CSCO-002/94701

4 sending said aggregated reply packet to said aggregation device.

1 39. (Original) The computer-readable medium of claim 37, further comprising
2 receiving in said aggregation device an aggregated reply packet from said peer aggregation
3 device, wherein said aggregated reply packet indicates the status of at least some of said
4 plurality of PPP sessions.

1 40. (Original) The computer-readable medium of claim 39, further comprising
2 sending a proxy keep-alive reply message to one of said plurality of end systems originating
3 a corresponding one of said keep alive-messages without waiting for said aggregated reply
4 packet.

1 41. (Original) The computer-readable medium of claim 40, further comprising:
2 maintaining a remote status table in said aggregation device, wherein said remote
3 status table indicates the status of sessions supported by said aggregation device;
4 updating said remote status table with the information in said aggregated reply packet;
5 and
6 generating said proxy keep-alive reply according to said remote status table.

1 42. (Original) A computer-readable medium carrying one or more sequences of
2 instructions for causing an aggregation device to process an aggregated request packet,
3 wherein said aggregated request packet indicates that the status of a plurality of point-to-point
4 sessions are requested, wherein execution of said one or more sequences of instructions by
5 one or more processors contained in said aggregation device causes said one or more
6 processors to perform the actions of:
7 examining said aggregated request packet to determine said plurality of point-to-point
8 sessions;
9 determining the status of each of said plurality of point-to-point sessions;
10 generating an aggregated reply packet indicating the status of said plurality of point-
11 to-point sessions; and
12 sending said aggregated reply packet to said peer aggregation device.

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884
Attorney Docket No.: CSCO-002/94701

1 43. (Original) The computer-readable medium of claim 42, wherein said determining
2 comprises accessing a local status table which contains the status information of at least some
3 of said plurality of point-to-point sessions.

1 44. (Original) The computer-readable medium of claim 42, wherein said generating
2 comprises including a client magic number associated with each of said plurality of point-to-
3 point sessions.

1 45. (Original) The computer-readable medium of claim 42, wherein said generating
2 comprises setting a bit to one logical value to indicate that a corresponding one of said
3 plurality of sessions is OK/alive, and to another logical value to indicate that said
4 corresponding one of said plurality of session not OK/alive.

1 46. (Original) The computer-readable medium of claim 42, wherein said aggregation
2 device comprises one of a network access server (NAS) and a home gateway implemented
3 in a communication network.

1 47. (Original) A communication network comprising:
2 a first aggregation device receiving a plurality of keep-alive messages generated by
3 a corresponding plurality of end systems, each of said plurality of keep-alive messages being
4 designed to request the status of a corresponding point to point (PPP) session implemented
5 on said communication network, said first aggregation device generating an aggregated
6 request packet which indicates that the status of said PPP sessions is requested, and sending
7 said aggregated request packet; and
8 a peer aggregation device receiving said aggregated request packet and indicating the
9 status of said plurality of sessions in an aggregated reply packet, said peer aggregation packet
10 sending said aggregated reply packet to said first aggregation device.

1 48. (Original) The communication network of claim 47, wherein said first
2 aggregation device is located at an edge of said communication networks.

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884
Attorney Docket No.: CSCO-002/94701

1 49. (Original) The communication network of claim 48, further comprising an access
2 network coupling said first aggregation device to said corresponding plurality of end systems,
3 wherein said plurality of keep-alive messages are received on said access network.

1 50. (Original) The communication network of claim 49, wherein said first
2 aggregation device and said peer aggregation device respectively comprise a network access
3 server (NAS) and a home gateway.

1 51. (Original) The method of claim 1, wherein said aggregation device is in the path
2 of all of said plurality of PPP sessions.

1 52. (Original) The method of claim 10, wherein said aggregation device is in the path
2 of all of said plurality of PPP sessions.

1 53. (Original) The invention of claim 15, wherein said aggregation device is in the
2 path of all of said plurality of PPP sessions.

1 54. (Original) The invention of claim 21, wherein said aggregation device is in the
2 path of all of said plurality of PPP sessions.

1 55. (Original) The invention of claim 25, wherein said aggregation device is in the
2 path of all of said plurality of PPP sessions.

1 56. (Original) The invention of claim 30, wherein said aggregation device is in the
2 path of all of said plurality of PPP sessions.

1 57. (Original) The computer readable medium claim 37, wherein said aggregation
2 device is in the path of all of said plurality of PPP sessions.

Reply to Final Office Action of December 21, 2004
Amendment Dated: February 17, 2005

Appl. No.: 09/785,884
Attorney Docket No.: CSCO-002/94701

1 58. (Original) The computer readable medium claim 42, wherein said aggregation
2 device is in the path of all of said plurality of PPP sessions.

1 59. (New) The method of claim 1, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 60. (New) The method of claim 10, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 61. (New) The invention of claim 15, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 62. (New) The invention of claim 21, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 63. (New) The invention of claim 25, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 64. (New) The invention of claim 30, wherein said aggregation device is physically
2 separate from said plurality of end systems.

1 65. (New) The computer readable medium claim 37, wherein said aggregation device
2 is physically separate from said plurality of end systems.

1 66. (New) The computer readable medium claim 42, wherein said aggregation device
2 is physically separate from said plurality of end systems.